

Contribution added after print:

## To Genus or not to Genus? Radiations and Paraphyly in Cyperaceae!

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Molecular studies in the Cyperaceae tribe Cyperaceae reveal major radiations, especially following the development of C<sub>4</sub> photosynthesis within the *Cyperus* clade in the late Miocene. This radiative burst lead to 950 species within the *Cyperus* clade. Several segregate lineages developed very specialized morphologies such as pistil dimerisations (e.g. *Pycneus* & *Kyllinga*) and shifts in seed dispersal units from nutlets to reduced spikelets (e.g. *Courtoisina*, *Kyllinga*, *Mariscus*), leading to secondary spikelets composed of reduced inflorescence parts (e.g. *Ascolepis* & *Lipocarpa*). Several of these segregates are polyphyletic, while others are well supported, but nested within the *Cyperus* C<sub>4</sub> hard polytomy.

In addition, generic concepts in Cyperaceae are blurred due to the presence of species in the sister group of the *Cyperus* clade, which converged with *Cyperus* in developing spikelets with distichous glume placement. On the other hand several lineages within *Cyperus* reversed towards spiral glume arrangements. While it is only possible to circumscribe the specialized lineages by character combinations (high degrees of homeoplasy), most segregates are easily recognizable.

These new insights place the classification of Cyperaceae on the slope. Three different strategies can be followed in developing a modern classification for paraphyletic giant genera: The first unpopular approach is splitting the rest group into smaller monophyletic genera. However, with the consequence many of these would be hardly distinguishable. The second approach is lumping the segregates within the larger entity, which is the strategy most followed in modern plant systematics. Both latter classifications follow the cladistic approach in only considering monophyletic taxonomic groups. However, in some groups (such as *Cyperus*), segregate lineages are not recognizable anymore as belonging to the original diverging group, they developed completely new morphologies and functional strategies. For these cases some authors suggested an evolutionary (or 'Linnean') approach, in which well-circumscribed segregate lineages are kept under separate generic names. Therefore nomenclature, which is artificial ad based on convention, is regarded separately from the phylogenetic classification. The latter strategy not only reflects the

evolutionary derived nature of the segregate lineages from the paraphyletic rest group (which is not yet extinct), it is also ensures nomenclatural stability which might be worth considering, especially when names have been widely used.

However, a new classification for the Cypereae is only possible after a full understanding of the relationships within the clade and better-resolved phylogenies are therefore indispensable. Until the application of novel research strategies leads to the resolving of the *Cyperus* C<sub>4</sub> hard polytomy we prefer to put the classification of Cypereae on hold!